



Malfunction Abatement Plan

for

REO Town Cogeneration Plant

Renewable Operation Permit Number

MI-ROP-B2647-2018b

March 1, 2022

I. OVERVIEW

The REO Town Cogeneration Plant is permitted to operate under Renewable Operating Permit MI-ROP-B2647-2018b (the ROP), issued by the Michigan Department of Environmental Quality. The REO Plant must be operated at all times, to the extent reasonably possible, in a manner consistent with good air pollution control practices for minimizing emissions during periods of abnormal conditions, startups and shutdowns, and malfunctions. Startups and Shutdowns have been addressed in the Startup and Shutdown Emissions Minimization Plan. After discovery (and corrective action) of an abnormal condition, procedures to prevent a future occurrence of the condition shall be incorporated into this plan.

The ROP requires that the following equipment shall have an MDEQ approved plan to prevent, detect, and correct malfunctions or equipment failures resulting in emissions exceedances:

1. EUCOOLTWR – A four-cell, mechanical draft cooling tower,
2. EUNGENINE – A 12.8 MMBtu/hr natural gas-fired, spark ignition, internal combustion emergency use engine for building power with a 1300kW generator,
3. EUAUXBOILER – A nominally rated 245 MMBtu/hr natural gas-fired auxiliary boiler,
4. EUTURBINE1 – A nominally rated 430 MMBtu/hr natural gas-fired turbine with an electrical generator,
5. EUTURBINE2 – A nominally rated 430 MMBtu/hr natural gas-fired turbine with an electrical generator,
6. FGTURB/HRSG1 – A nominally rated 430 MMBtu/hr natural gas-fired turbine, a HRSG with a nominally rated 71.4 MMBtu/hr natural gas-fired duct burner and an electrical generator operating in combined-cycle mode, and
7. FGTURB/HRSG2 – A nominally rated 430 MMBtu/hr natural gas-fired turbine, a HRSG with a nominally rated 71.4 MMBtu/hr natural gas-fired duct burner and an electrical generator operating in combined-cycle mode.

A. Limitation

This plan is one element of the Renewable Operating Permit. The procedural steps in Section II below do not include all permit requirements; they are only intended to present the steps

necessary for preventing, detecting, and correcting malfunctions or equipment failures that result in emissions exceedances.

II. MALFUNCTION ABATEMENT PROCEDURES

All emissions exceedances are to be reported to the Environmental Department within 24 hours. Emissions during startups and shutdowns will be minimized by following the Startup and Shutdown Emissions Minimization Plan and the manufacturers' written procedures. The Supervisory Personnel responsible for overseeing the inspection, maintenance, and repair of REO equipment is as follows:

1. Production Plant Manager - The Plant Manager is responsible for:

- Monitoring daily opacity
- Assuring all inspection records are maintained.
- Assuring all maintenance is coordinated.
- Assuring all structural, electrical and mechanical inspections are completed.
- Coordinating and directing all maintenance work.
- Maintaining the spare parts inventory in coordination with the Production Warehouse Planner in the Purchasing and Warehousing Department.

A. The Cooling Tower - EUCOOLTWR

The cooling tower consists of four individual cooling cells that remove heat from the plant auxiliary cooling water and circulating water systems. The cooling tower was manufactured by Composite Cooling Solutions, L.P. and is of the mechanical draft, counterflow design, rated for 17,000 gpm (4,250 gpm per cell) with a guaranteed drift loss of 0.001 percent of design flow.

1. Operating Parameters

Emissions of particulate matter are controlled by proper water chemistry and maintenance of the cooling tower drift eliminators. Normal operating ranges are as follows:

- I. Water circulation rate: 2,500 - 17,000 gpm
- II. Cooling water total dissolved solids (TDS): 1,500 ppm maximum

2. Equipment monitoring

Plant operating personnel will perform daily monitoring of the cooling tower operating parameters in addition to visual and physical inspections of the drift eliminators whenever the cooling tower is being operated. The amount of emissions will be calculated monthly based on actual readings for the operating parameters and the manufacturer's certified maximum drift rate of 0.001 percent.

3. Preventative Maintenance

A regular inspection and maintenance program will be used to ensure proper operation. The program will include daily, weekly, semi-annual and annual inspections as appropriate based on actual operating data, hours of operation, manufacturer's recommendations and results of previous inspections.

4. Responses to Malfunctions

Whenever malfunctions are encountered and when appropriate, the tower or appropriate cell will be shutdown by operations personnel. The tower/cell will not be operated until maintenance has been performed to correct the malfunction.

B. The Auxiliary Gas Engine/Generator - EUNGENGINE

The Auxiliary Gas Engine/Generator is a model G3516 manufactured by Caterpillar. The engine is a gas fired spark ignition internal combustion engine fired exclusively with natural gas. The engine is equipped with an electronic control system that provides dependable firing and precise control of combustion/operation along with extensive system diagnostics. The Auxiliary Gas Generator operates at 1800 rpm and is rated for 1300 KW output. It provides emergency power for the REO Town Plant yet is not a black start engine.

1. Equipment monitoring

Plant operating personnel will perform periodic visual and audible monitoring of the emergency generator whenever it is being operated. In addition, the engine/generator electronic control system will continuously monitor engine operation. Whenever an abnormal condition is detected the control system will provide abnormal event codes, alarms and shut the engine down if appropriate. In addition to monitoring critical operating variables the control system is designed to automatically operate the engine as efficiently as possible over its load range.

2. Preventative Maintenance

A regular inspection and maintenance program will be used to ensure proper operation. The program will include weekly, semi-annual and annual inspections as appropriate based on actual operating data, hours of operation, manufacturer's recommendations and results of previous inspections.

3. Responses to Malfunctions

Whenever malfunctions are encountered and when appropriate, the engine will be shutdown automatically by the engine electronic control system or manually shutdown by operations personnel. The engine will not be operated until maintenance has been performed to correct the malfunction.

C. The Auxiliary Boiler (or the Package Boiler) - EUAUXBOILER

The Auxiliary Boiler is a series D style manufactured by Victory Energy and is fired exclusively with natural gas. The boiler is equipped with an electronic control system that provides dependable firing and precise control of combustion/operation along with extensive system diagnostics. The Auxiliary Boiler provides steam for the downtown heating district when a combustion turbine and/or HRSG is out of service and also for periods of peak demand. Steam produced by the Auxiliary Boiler is not used for the production of electricity. Designed to produce 175,000 lbs/hr of steam at 450 psig 660°F.

1. Equipment monitoring

The boiler combustion control system will continuously monitor boiler operation and automatically respond to changing conditions within the boiler, including, if necessary, initiating shut down procedures. Plant operating personnel also perform periodic monitoring of boiler operating temperature, pressure and emissions in addition to visual and audible inspections whenever the boiler is being operated. Emissions from the boiler will be continuously monitored by the Continuous Emissions Monitoring System (CEMS) installed on the exhaust stack. The CEMS will be recorded through a Data Acquisition and Handling System (DAHS) with a dedicated display in the operator control room. This display will also provide visual and audible alarms to alert the operators should any emissions exceed their permitted limits.

2. Preventative Maintenance

A regular inspection and maintenance program will be used to ensure proper operation. The program will include weekly, semi-annual and annual inspections as appropriate based on actual operating data, hours of operation, manufacturer's recommendations and results of previous inspections.

3. Responses to Malfunctions

Whenever malfunctions are encountered and when appropriate, the boiler will be shutdown automatically by the engine electronic control system or manually shutdown by operations personnel. The boiler will not be operated until maintenance has been performed to correct the malfunction.

D. The Combustion Turbines (EUTURBINE1 & EUTURBINE2)

The Plant contains two Combustion Turbine/generator sets and each is a model LM6000 PF manufactured by GE Packaged Power, Inc. Each combustion turbine is fired exclusively with natural gas. The turbines can be operated in simple-cycle mode, as described in this section D, or combined-cycle mode, as described below in Section E. Each turbine/generator set is equipped with an electronic control system that provides dependable firing and precise control

of combustion/operation along with extensive system diagnostics. Each turbine/generator set operates at 3,600 rpm and is rated for 44,000KW @ 13.8KV/3Ph/60Hz.

1. Equipment monitoring

The turbine electronic control system will continuously monitor turbine operation and when appropriate initiate a fuel trip and purge to shut the turbine(s) down. Plant operating personnel will perform periodic monitoring of turbine critical operating parameters and emissions in addition to visual, audible and physical inspections whenever it is being operated.

Emissions from the turbine will be continuously monitored by the CEMS installed on the exhaust stack. The CEMS will be recorded through a DAHS with a dedicated display in the operator control room. This display will also provide visual and audible alarms to alert the operators should any emissions exceed their permitted limits.

2. Preventative Maintenance

A regular inspection and maintenance program will be used to ensure proper operation. The program will include weekly, semi-annual and annual inspections as appropriate based on actual operating data, hours of operation, manufacturer's recommendations and previous inspection results.

3. Responses to Malfunctions

Whenever turbine malfunctions or abnormal emissions are encountered and when appropriate, the turbine(s) will be shutdown automatically by the engine electronic control system or manually shutdown by operations personnel. The turbine(s) will not be operated until maintenance has been performed to correct the malfunction.

E. The Heat Recovery Steam Generators (FGTURB/HRGS1 & FGTURB/HRGS2)

Each combustion turbine is attached to a Heat Recovery Steam Generator (HRSG) manufactured by Innovative Steam Technologies. The HRSGs are once-through steam generators (OTSG) designed to pass all of the steam they produce out to customers or to vents. The turbines do not have bypass stacks so all of the turbine exhaust gas passes through

the HRSG prior to leaving the plant through a stack which is continuously monitored for emissions compliance by a CEMS (the same type of CEMS that is described in Section D). The HRSGs can be operated to produce steam, or in a “dry” mode in which no steam is produced. The HRSGs themselves are also equipped with duct burners for supplemental natural gas firing. Emissions from the HRSGs occur only when the duct firing is in operation, and exit the stack combined with the combustion turbine exhaust gases. All the exhaust gases are monitored by a CEMS. Each duct burner is equipped with an electronic control system that provides dependable firing and precise control of combustion/operation along with extensive system diagnostics. Each HRSG has a maximum designed heating capacity of 173,257 lbs/hr steam at 350 psig and 655°F.

1. Equipment monitoring

The duct burner combustion control system will continuously monitor burner operation and when appropriate initiate a fuel trip to shut the burners down. Plant operating personnel will perform periodic monitoring of the HRSG operating temperature, pressure and emissions in addition to visual and audible inspections whenever it is being operated. HRSG emissions are continuously monitored by the CEMS installed on the exhaust stack. The CEMS will be recorded using a DAHS with a dedicated display in the operator control room. This display will also provide visual and audible alarms to alert the operators should any emissions exceed their permitted limits.

2. Preventative Maintenance

A regular inspection and maintenance program will be used to ensure proper boiler and burner operation. The program will include weekly, semi-annual and annual inspections as appropriate based on actual operating data, hours of operation, manufacturers recommendations and results of previous inspections.

3. Responses to Malfunctions

Whenever malfunctions are encountered and when appropriate, the duct burners will be shutdown automatically by the combustion control system or manually shutdown by

operations personnel. The duct burners will not be operated until maintenance has been performed to correct the malfunction.

III. RECORDKEEPING

All records shall be provided to the BWL’s Environmental Department which will be responsible for maintaining the records in accordance with the BWL’s records retention policy.

- A. Records of startups and shutdowns of the equipment will be kept in the plant log books.
- B. During an abnormal startup or shutdown, records of the event shall be recorded including the time, date, probable cause(s), duration, affected equipment, emission estimates, and the corrective actions taken in response to the abnormal event.
- C. Records of CEMS activities, including emissions readings, calibrations, analyzer maintenance, and downtime shall be maintained in a DAHS.

IV. PLAN REVIEWS AND REVISIONS

Date	Editor(s)	Action
8/19/2013	Angie Goodman Bob Nicholson	Draft
9/4/2013	Angie Goodman Roberto Hodge	Draft to Final
7/7/2016	Sue Pemberton	Draft Update
12/06/2019	Nathan Hude	Review for applicability, grammar changes
03/01/2022	Nathan Hude	Review for ROP Renewal, no changes